
1. INTRODUCTION

Background

This manual is provided to assist Installation and Base Realignment and Closure (BRAC) Cleanup Teams, USAEC restoration oversight managers (ROMs), and other personnel responsible for environmental restoration activities in performing related duties in an expeditious and cost-effective manner. The guidance provided herein is drawn from the collective experience of environmental restoration managers working on both public and private lead sites since the inception of environmental restoration programs in the United States. Those programs were formally promulgated with the development of the National Multi-Agency Oil and Hazardous Materials Pollution Contingency Plan (later to become the National Contingency Plan or NCP) in 1968. Over the years, the plan has evolved in response to lessons learned and Congressional mandates included in legislation such as the Federal Water Pollution Control Act (FWPCA) Amendments, the Resource Conservation and Recovery Act (RCRA), the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), and the Superfund Amendments and Reauthorization Act (SARA).

Concentrated efforts in environmental restoration began in the 1980s with passage and implementation of CERCLA. With time, it became apparent that Congress had underestimated the size of the undertaking both in terms of the number of sites that would have to be addressed and in the cost for addressing a typical site. In part, the funding shortfall was believed to arise from inefficient allocation of resources in program execution. Consequently, funding was increased and pressure was applied to improve performance. Both private and public entities began to study ways to reduce the cost and improve the outcome of restoration activities. The U. S. Environmental Protection Agency (EPA) developed and launched the Superfund Accelerated Cleanup Model (SACM), an approach that utilized the flexibility inherent in the NCP to eliminate nonessential investigation costs. This was followed by the development of the Streamlined Approach for Environmental Restoration (SAFER) by the U. S. Department of Energy (DOE). In the private sector, the American Society for Testing and Materials (ASTM) initiated the Risk-Based Corrective Action (RBCA) Program.

In 1997, the Army Environmental Center (AEC) launched a peer review process and subsequently the Independent Technical Review (ITR) Program as a means of validating the approaches being taken to environmental restoration at BRAC and, more recently, active sites as well as to identify opportunities for streamlining. With implementation of the reviews, it was observed that a number of issues were repeatedly encountered at sites regardless of the regulatory program under which the work was being conducted. Many of the more significant findings were summarized in a recent review of 27 ITR recommendation reports. These findings include:

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- There is a need to better document and communicate decisions.
 - There is a need to focus activities on core problems.
 - ✓ In 9/27 cases, risk was calculated for scenarios inconsistent with the site use plan.
 - ✓ In 10/27 cases, the conceptual site model was developed as a by-product, not used as a tool to scope studies.
 - ✓ In 8/27 reported risk resulted from contaminants present in background samples.
 - ✓ There was a common misconception that if an applicable or relevant and appropriate requirement (ARAR) is exceeded, a response is required.
 - Data collection is often performed ineffectively and inadvisably.
 - ✓ In 13/27 cases, the Data Quality Objectives process was not employed.
 - ✓ There was confusion between data gaps and data needs.
 - ✓ Efforts were being expended to characterize incomplete pathways.
 - There is no early focus on likely response actions and the subsequent impact on data needs.
 - ✓ In 6/27 cases, the remedy cost more than the value of the resource being restored.
 - ✓ In 9/27 cases, monitored natural attenuation was not considered even though conditions appeared to meet EPA policy guidelines for selection.
 - ✓ In 12/27 cases, remedies were implemented with no exit strategy articulated.
 - There is a tendency to default to more data collection in an ill-fated attempt to resolve all site uncertainties.

As a result of these findings and their consistency with observations made with the previous streamlining initiatives, key concepts for resolution of these problems have been identified and distilled into the Principles that are the core of this manual. Additionally, tools have been developed to assist in implementing the four principles.

The four Principles of Environmental Restoration are:

- **Developing effective communication and cooperation with a Project Management Team (PMT) is essential;**
- **Clear, concise, and accurate problem identification and definition are critical;**
- **Early identification of likely response actions is possible, prudent, and necessary; and**

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- **Uncertainties are inherent and will always need to be managed.**

Applicability of the Principles in the Restoration Process

The Principles presented in this manual are not new concepts in and of themselves. Rather, they are implicit in both the NCP and RCRA corrective action policies. They can be applied at any point in the remediation process, and to any remediation or investigation, regardless of the type or magnitude of the problem being addressed. In order to understand and embrace these Principles, the reader must first recognize that both CERCLA and RCRA explicitly provide for flexibility in what can be done, assuming certain basic steps are followed. Historically, however, this regulatory and policy flexibility has not been well implemented. For example, the emphasis of both programs is to decide whether to take action to solve problems. The traditional approach to reaching this decision has been to conduct extensive site investigations and studies to collect as much data as possible about the site, and to then make a decision as to whether or not to move forward. Under this approach, data collection and investigation become the focus of the process rather than a means to achieving an end. However, as will be illustrated throughout this manual, activities such as collecting data should be done when it fills clearly defined data needs that can support the decision-making process (i.e., not all data gaps will be filled). If embraced, application of the Principles can save resources in terms of both time and dollars, while at the same time promote a better, more strategic decision-making process. Figure 1-1 illustrates the parallel elements of the RCRA and CERCLA processes, and Figure 1-2 illustrates how the four Principles can be applied throughout the remediation process.

Figure 1-1: The Parallel Elements of RCRA and CERCLA Processes

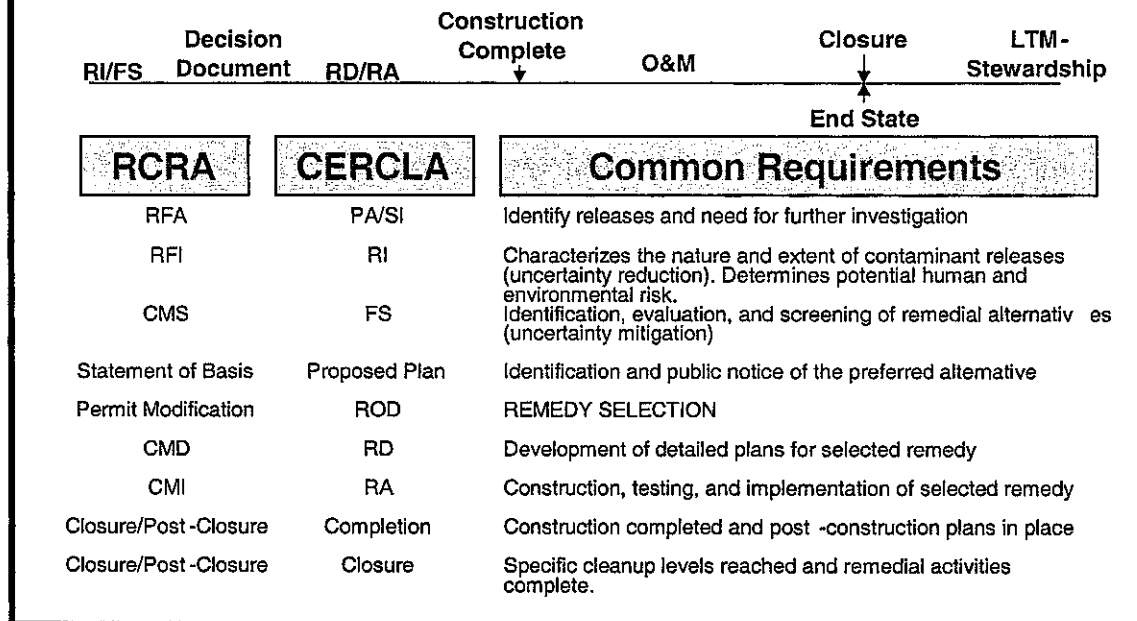


Figure 1-2: The Principles Apply to All Phases of Environmental Restoration

	Pre-Decision Document		Post-Decision Document	
Principle	Scoping	RI/FS/REI/CMS	RD/RA	Post Completion
Develop effective communication and cooperation within a PMT is essential	Articulate problem to stakeholders	Approve uncertainty management strategy and select preferred remedy	Develop common interpretation of decision document	Approve contingency implementation and conduct 5-year reviews
Clear, concise and accurate identification of problem is critical	Define the problem	Identify decisions that address the problem and focus efforts to determine needed information	Define remedial action objectives	Define end-states measure performance
Early identification of likely means of achieving objectives is possible, prudent, and necessary	Identify hierarchy of preferred alternatives	Focus investigations on fatal flaws and selection/design criteria	Select design basis and use to determine significance of uncertainties	Prepare performance expectations to evaluate progress and provide early warning of failure
Uncertainty is inherent and must be managed	Distinguish data needs from data gaps	Balance uncertainty reduction with countermeasures to impacts that effect remedy selection	Determine uncertainties with sufficient impact to require contingencies	Monitor conditions as a means of determining when contingencies must be implemented

Organization

The manual begins with a discussion of each of the four Principles and their interrelationships during conduct of environmental restoration activities. Chapter 2 describes the critical need for communication and cooperation among stakeholders (Principle 1) to advance the environmental restoration effort and, where appropriate, facilitate property transfer. The third chapter introduces the concept of identifying problems (Principle 2) and formulating problem statements to focus subsequent efforts. Chapter 4 addresses the utility of early identification of likely response actions (Principle 3) as a means of focusing investigations once a problem has been defined. Finally, the concept of uncertainty management (Principle 4) is introduced in Chapter 5. Each Principle is discussed in detail along with examples of tools for implementation and output illustrating its use and utility.

The concluding four chapters deal with the application of the Principles during conduct of environmental restoration activities. Chapter 6 addresses the formulation and use of conceptual site models as a means of retaining internal consistency and focus. Chapter 7 introduces methods such as the Data Quality Objectives (DQO) process and dynamic decision making as means of reducing uncertainty through data collection. Uncertainty management through mitigation of residual uncertainties is described in Chapter 8. Chapter 9 concludes with a discussion of the need for exit strategies and long-term care implications of common remedies.

Supplemental materials appended to the manual include design basis and fatal flaw listings for common remedial actions, references, and additional decision logic diagrams to assist in planning investigations.

Assumptions

This manual was developed with the assumption that the user is an Army project manager, decision maker, design engineer, or line manager; lead regulator; or otherwise responsible party with the authority to determine the direction and content of environmental restoration activities at active or BRAC Army installations. The reader is expected to be conversant in environmental restoration program fundamentals such as regulatory framework and programmatic mission. In general, the reader is assumed to be a "reviewer" rather than a "doer" (i.e., responsible for planning and reviewing work products such as investigation reports and designs, not in actually performing the technical work required during the investigation, design and implementation).

It is assumed that the environmental restoration activity is being conducted under CERCLA or the corrective action aspects of RCRA. While issues such as lead-based paint and asbestos removal may benefit from application of the Principles, these activities are not contemplated in the examples provided or the

accompanying text. No assumptions are made with respect to the stage of restoration that has been reached. Information is provided relative to all phases of activities including pre-decision document (preliminary assessment, scoping, investigation and remedy selection) and post-decision document (design, implementation, and stewardship) activities.

Objectives

This manual is a companion to the Principles of Environmental Restoration Workshop organized and sponsored by the Army Environmental Center. It is designed to supplement materials presented during the course, and to act as a stand-alone guidance for those unable to attend a course delivery. It is designed to help the reader understand the Principles and learn how to apply them in practical ways throughout restoration activities. The Principles presented in this manual do not provide a recipe for conducting studies. Rather, they provide a framework and an approach to work plan development and review, and decision making in which different methodologies can be embedded. Each user is encouraged to select methodologies consistent with the Principles and assemble them in a manner that is best suited to the site and the stakeholders in a given situation. It is far more important at this juncture for the reader to understand why certain actions are recommended rather than how they are to be implemented.

After reading this manual, it is expected that the user will:

- Understand the Principles of Environmental Restoration and their applicability to all phases of restoration activities;
- Recognize the flexibility available in the NCP and site-specific decision documents that facilitate streamlining; and
- Appreciate why specific elements of environmental restoration are necessary rather than feel committed to a specific process for how those elements can be conducted.

Success in implementing this approach is directly related to the degree to which each stakeholder embraces the Principles and their application. One of the objectives of the Workshop is demonstration of the efficacy of this approach from the perspectives of the regulators, the Army, and other stakeholders. A corollary objective is to explain the utility of the Principles in:

- Encouraging strategic thinking, team building, and problem solving;
- Seizing opportunities for cost and schedule streamlining; and
- Improving communication with all stakeholders.